Lowering of blood glucose and its variability by computerized decision support

Riddersholm, Signe Juul; Preiser, Jean-Charles; Rousing, Mark Lillelund; Pielmeier, Ulrike; Andreassen, Steen

Publication date:
2012

Document Version
Accepted author manuscript, peer reviewed version

Lowering of blood glucose and its variability by computerized decision support

Signe Juul Riddersholm, MD; Jean-Charles Preiser, MD; Mark Lillelund Rousing, M.Sc.; Ulrike Pielmeier, PhD, M.B.A.; Steen Andreassen, PhD, Dr. Tech.

Aalborg University, Center for Model-based Medical Decision Support, Aalborg, Denmark
sjr@hst.aau.dk

Objective:
The safety and effectiveness of a medical decision support system controlling stress hyperglycemia (Glucosafe), was tested prospectively in a medico-surgical intensive care unit (ICU) with a heterogeneous patient population. Using penalty functions for insulin and blood glucose, Glucosafe balances insulin treatment against glycemic outcome.

Method:
Insulin treatment was provided according to the local usual insulin algorithm (days 1 and 3) or according to Glucosafe (day 2) to reach the target range of 90-150 mg/dl. Nutrition was provided according to departmental guidelines. After the first 6 patients penalty functions were adapted by increasing target blood glucose from 99±10% to 104±10% mg/dl and increasing the penalty for high insulin doses.

Results :
Glucosafe was tested on 13 patients (age: 69.8±11.1; SAPS II: 44 ± 16). The use of Glucosafe reduced both the intrapatient mean and SD of blood glucose significantly on day 2 (mean: 104 ± 7 mg/dl;N=98) relative to both day 1 (mean: 140 ± 11 mg/dl; N = 90, $p<0.0005$) and day 3 (mean: 116 ± 10 mg/dl; N = 60, $p<0.005$). Hypoglycemia (< 60 mg/dl) was not observed on any day.
On day 2 (Glucosafe) 78% of measurements were in the target range compared to 67% on day 1 and 74% on day 3.
On average insulin doses for days 1 and 3 combined were 2,08 units/h. Glucosafe used higher average insulin doses (3.62 and 2.4 units/h) before and after the adaptation of the penalty function. There was no significant difference in glycemia before and after the adaptation.

Conclusion:
Using Glucosafe with penalty functions adapted to the local environment safely improved the performance of glycemic control.